NATIONAL INSTRUCTION NO. 430-302, THIRD EDITION

SUBJECT: SOI – STATE SOIL GEOGRAPHIC DATABASE UPDATE

PART 302 - STATE SOIL GEOGRAPHIC DATABASE UPDATE

302.1 (e)

302.0 Purpose.

This instruction establishes criteria and minimum requirements for updating the State Soil Geographic (STATSGO) database to the Digital General Soil Map of U.S. It also changes the managing of STATSGO as State subsets of a national database to a concept of managing STATSGO as a national data set with a national legend and State ownership of individual map units. This instruction also changes the official database name from the STATSGO database to the Digital General Soil Map of U.S.

The project should be completed by September 30, 2002.

302.1 Background.

The STATSGO database was started in 1984 and published in 1994. STATSGO was compiled at a scale of 1:250,000 for all areas except Alaska, which was compiled at a scale of 1:1,000,000. It is used extensively by the Natural Resources Conservation Service (NRCS), other Federal and State agencies, universities, industry, international groups, and the general public. Most State, regional, and national soil thematic maps are derived from the 1994 STATSGO data. STATSGO consists of about 81,400 polygon, 10,900 map unit, 118,600 component, and 382,000 layer records that need updating because of the following deficiencies:

(a) Map and tabular data and metadata are outdated and do not adequately meet NRCS program needs;

(b) Location accuracy of some of the map data does not meet map accuracy standards and should not be used with other data layers developed at a comparable scale;

(c) Design, quality, and correlation of map units between States are not always consistent;

(d) Map unit design was by State, not Major Land Resource Area (MLRA);

(e) There is a need to incorporate information from detailed soil surveys completed since 1984;

302.1 (f)

(f) Tabular data are held in a frozen 1993 data set (data model is the outdated State Soil Survey Data Base);

(g) Tabular data model is not compatible with the National Soil Information System (NASIS) used with detailed soil surveys;

(h) Soil tabular data have become obsolete and are not the best data to provide answers to national, regional, or State questions or to develop and test new kinds of soil interpretations for the Nation;

(i) Metadata do not meet the current Federal Geographic Data Committee (FGDC) Metadata Standard; and

(j) National soil assessments will be negatively impacted if we continue to use STATSGO in its present condition.

302.2 Purpose of the Digital General Soil Map of U.S.

(a) The purpose of the Digital General Soil Map of U.S. is to link digitized soil map delineations with computerized data on map unit acreage, proportionate extent of the component soils in each map unit, and soil properties. With the Digital General Soil Map of U.S., the NRCS will be able to store, retrieve, analyze, and display soil data efficiently and to connect soil data with other spatially referenced resource and demographic data in a geographic information system.

(b) Digital General Soil Map of U.S. will provide:

(1) A nationally consistent soil geographic database;

(2) Soil data compatible with other data digitized from 1:250,000-scale maps such as land use/land cover, political boundaries, and federally-owned land;

(3) Soil information at a level of detail that could be used for a State or broader geographic information system;

(4) A set of consistent, joined county general soil maps of the same scale that could be used for a State or broader geographic information system; and

(5) Maps compatible with digital data from the Landsat Multiple Spectral Scanner, Advanced Very High-Resolution Radiometer (AVHRR) sensor, or other comparable sensors.

(c) Maps generated from the database can be used to:

(1) Provide interim general soil data for areas where digital detailed soil survey maps are not complete;

(2) Provide general soil data to determine optimal locations for various uses;

(3) Estimate soil erosion and analyze soil loss across multi-county or multi-soil survey areas;

(4) Provide general soil maps for publications in soil survey and watershed reports;

(5) Analyze soil information together with other resource information for the State, region, or Nation in a geographic information system; and

(6) Provide soil data for small-scale digital soil and ecoregion mapping of North America.

302.3 Action items.

(a) The Information Technology Center (ITC) and the National Soil Survey Center (NSSC) staffs will convert the existing STATSGO data to the NASIS 5.0 format. After conversion, State soil survey staff may match and replace all or selected converted map unit component data with edited detailed soil survey NASIS component data. All data will be reviewed and correlated to the map data in item (b) below.

(b) State soil survey staffs will request a digital copy of the new merged map data with symbolization from the national map legend which will be used for any map updates.

(c) State soil survey staffs may update map data in areas where soil surveys have been completed since the release of STATSGO or in other areas where deficiencies exist. Published general soil maps ratioed to a scale of 1:250,000 on a mylar base may be requested and used for compilation if they meet the needs of the State and the specifications in this document.

(d) MLRA Soil Survey Region Office (MO) leaders are responsible for quality assurance of any updates and for correlating joins between States and MLRA Soil Survey Regions.

(e) MO leaders will send updated digital map data to Fred Minzenmayer at the National Cartography and Geospatial Center (NCGC) for incorporating into the national data set.

(f) MO leaders will coordinate updates with States and determine compilation materials to order through the NCGC.

(g) MO leaders and State conservationists will certify MLRA Soil Survey Region subsets of the Digital General Soil Map of U.S. before September 2002 using the form given in Exhibit 648-1 of the National Soil Survey Handbook (NSSH).

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302.4 Target dates.

Tasks may be accomplished and submitted prior to target dates to expedite the program.

(a) PRE-CONVERSION

What	When	Who	Revised Date
(1) Assign 1:250,000-scale quad-rangles to MO for quality assurance	Dec. 1999	Team	Complete
(2) Correlate map units and edit maps to remove State lines for a seamless national layer for the 48 contiguous States	Mar. 2000	Team/MO	Complete
(3) Establish ownership of each map unit	Mar. 2000	Team	Complete
(4) Develop a national legend for for all STATSGO map units	Mar. 2000	Team/MO	Complete
(5) Inventory States for original United States Geological Survey (USGS) mylar topographic base maps and registered punched overlays	Apr. 2000	MO	Complete
(6) Order compilation materials from NCGC--includes USGS 1:250,000-scale topographic base maps and punched overlays	Apr. 2000	MO	Complete
(7) Inventory States and order ratioed general soil maps from NCGC	Apr. 2000	MO	Complete
(8) Establish global conversion rules and exception handling	Apr. 2000	Team/ITC	Complete
(9) Test NASIS/STATSGO component matching	May 2000	Fortner Egley	Aug. 2001
(10) Revise metadata to comply with current FGDC standard	May 2000	Team	Sept. 2001

(11) Revise and fix conversion software	May 2000	ITC	June 2001
(12) Revise taxonomic classification of series in Soil Classification file	Jun. 2000	Team/MO/ Soil Tax Staff	July 2001
(13) Conduct STATSGO Customer Survey		Team/NSSC/ SSD	July 2001
(14) Create conversion component link tables for water tables, pans, cation-exchange capacity, and rubbly surface textures	Jul. 2000	MO/States	Complete
(15) Convert tabular data	Jul. 2000	ITC	Aug. 2001
(15.1) Develop NASIS report for component taxonomic classification check against Soil Classification File		Team/Iowa State Univ./ Engel	Sept. 2001
(15.2) Present results of Customer Survey		Team/NSSC/ NHQ	Aug. 2001
(15.3) Complete export structure		Team	Sept. 2001
(b) POST-CONVERSION			
(16) Complete STATSGO/NASIS component update	May 2001	MO/States	May 2002
(17) Complete digital map data revision	Jun. 2001	MO	May 2002
(18) Revise metadata content	Jun. 2001	MO	May 2002
(19) Final review and validation of taxonomic class of STATSGO components with Soil Classification File	Jul 2001	MO/States	June 2002
(20) Create MLRA/NASIS overlap table from revised Agriculture Handbook 296 map	Aug. 2001	Team	July 2002

302.4 (b) (21)

(21) Complete quality review and assurance – includes correlation of joins and tabular data to map data	Aug. 2001	MO/States	July 2002
(21.1) National correlation of tabular and map data		NSSC	Aug. 2002
(22) Each MO Leader to submit a certification letter for the Digital General Soil Map of U.S.	Sep. 2001	MO	Aug. 2002
(23) Archive the Digital General Soil Map of U.S. at NCGC	Sep. 2001	MO	Sept. 2002

302.5 Responsibilities.

Responsibilities for the STATSGO database are in Part 648.01 of the current version of the NSSH. In addition, a STATSGO Project Coordinator and update team has been appointed to provide oversight and direction to conduct and complete the update. The State soil survey staffs are responsible for the development of the Digital General Soil Map of U.S., while the MO leaders are responsible for quality assurance including correlation and joining.

302.6 Minimum update requirements.

The Soil Survey Division has set a goal of delivering the Digital General Soil Map of U.S. by the end of 2002. Tabular data will be delivered in the NASIS format from a single national legend. Map data will be maintained in a national layer and delivered in specified geographic extents. Metadata will be revised to current FGDC standards.

The minimum steps to update STATSGO to the Digital General Soil Map of U.S. are to:

(a) Assign each 1:250,000-scale quadrangle to a MO for quality assurance responsibility;

(b) Assign each map unit to a State for edit responsibility;

(c) Select common map unit composition and map unit identifier across State lines;

(d) Correlate map units to remove State lines (i.e., no geopolitical polygon boundaries);

(e) Edgematch all map unit polygons and correlate them to the tabular data;

(f) Convert State Soil Survey Data Base tabular data to the NASIS database;

(g) Revise metadata for content and to compliance with the new FGDC standard;

(h) Develop a national correlated Digital General Soil Map of U.S. legend and manage as a single NASIS legend;

(i) Revise taxonomic classification of components, especially for the new orders of Andisols and Gelisols;

(j) Archive map data in a seamless national layer for the 48 contiguous States, with separate layers for Alaska, Hawaii, and Puerto Rico with U.S. Virgin Islands; and

(k) Submit letter certifying revised data for distribution.

302.7 STATSGO tabular data update.

A two-phase approach consisting of data conversion to NASIS and converted STATSGO component replacement will be implemented. This approach meets the requirements of most States and produces data for all States even if some States do not have the resources to perform the component update. States can choose to do any level of component replacement. An application will be developed by the ITC staff to search the NASIS database for component matches based on STATSGO component phase criteria. Selections by the State survey soil staffs will be directed to a lookup table. When all desired matches are complete, another application will perform the cut/paste operations. The lookup table of component matches will be stored for a subsequent data refresh.

(a) Phase 1 - Tabular data conversion (required).

(1) All STATSGO State Soil Survey Data Base (SSSD) tabular data will be converted to NASIS 4.1 format.

(2) Perform analysis for exception handling, degree of cleanup, differences between SSSD conversion and STATSGO conversion, fixing known conversion routine bugs, and addressing additional symbol handling. Exception handling is the logic and rules for handling database field values that can not be matched to a NASIS domain. An example is plant symbols. Some States may choose to edit all plant symbols that do not exist in the national list. Others may choose to have matched symbols converted and unmatched symbols written to an ASCII file for information or for later reconciliation.

(3) Flag dominant surface texture in horizon table of the converted data.

(4) Modify the SSSD conversion software.

(5) Establish global conversion rules or component link tables for State or regions.

(6) Remove prime farmland classification field from the component table and store in the NASIS component interpretation table.

302.7 (a) (7)

(7) Retain all original symbols.

(8) Create a MLRA NASIS overlap table.

(b) Phase 2 – STATSGO/NASIS component match and replace (optional).

(1) Populate a NASIS central server. This is required to proceed.

(2) Use ITC-developed software to generate a choice list of potential matches of a STATSGO component based on selected criteria. The list would include survey area name and total acres and would originate with SSURGO level components in NASIS.

(3) Use ITC-developed automated post processing (copy/paste) to replace an existing STATSGO component with the chosen SSURGO component.

(4) Use an option to retain some attributes such as component names and component percents from the original STATSGO data.

(5) Use Iowa State University-developed Soil Classification File checking reports and existing NASIS tools to update STATSGO component classification according to Agriculture Handbook 436, Second Edition, Standard.

302.8 Map unit specifications.

(a) Delineations.

(1) Approximate minimum area to be mapped is 625 hectares (1,544 acres); this is represented on a 1:250,000-scale map by an area approximately 1 cm x 1 cm (0.4 in x 0.4 in). Linear delineations should be not less than 0.5 cm (0.2 in) in width. The number of delineations per 1:250,000 quadrangle will generally range from 100 to 200, but may range up to about 400.

(2) Political boundaries, such as county and State, will not be used as delineation boundaries. Map units may occur in more than one MLRA. This relationship will be handled in the MLRA “overlap” table in NASIS.

(b) Components.

(1) In general, map units will be a combination of associated phases of soil series that will enable the most precise interpretations. However, for those areas where soil series are not established or are not adequately described, some map units can be combinations of associated taxonomic subgroups or families. Components can also be miscellaneous land types such as rock outcrop, sand dunes, or playas. Water areas not large enough to delineate, but of sufficient composition will be included as components of map units.

(2) Map units will have a maximum of 21 soil components. When there is a need to combine minor soils to keep the number of components down, use similar interpretations as a basis for combining. Components comprising only one or two percent of the composition should probably be combined with other units unless they are contrasting and there are considerable differences in behavior from other more extensive soils. Highly contrasting components should be kept separate even though they are minor. For instance, one percent rock outcrop is significant and should be identified in the composition.

(3) Not all components are expected to be found in all delineations of a general soil map unit and percent composition may vary by delineation.

(4) The information about map units will include reliable estimates of the kinds of components and their percent composition. The methods by which the composition was determined will also be included. Composition will be determined by such means as transecting representative segments of map units, measuring components, or calculating in a geographic information system from digital Soil Survey Geographic (SSURGO) data. Transects may be observed in the field; however, it is more likely that they will be located and examined on soil survey field sheets or in published soil surveys.

302.9 Labeling State-shared map units.

Tabular data redundancy will be removed. The redundancy exists because State boundaries were used as polygon boundaries. Tabular data are repeated as many times as the number of States that a map unit occurs in. The procedure will be to:

(a) Identify map units that join along State lines and eliminate any mislabeling from 1994 source;

(b) Develop a list of joining map units and their total acres in each State;

(c) Relabel map unit(s) in the State(s) with lesser total acres to the map unit of the State with the largest total acres;

(d) Remove the State boundaries separating similar map units in adjacent States; and

(e) Create a national legend and add the new legend symbols to the digital map layers and tabular data. All original STATSGO symbols will be retained in NASIS as additional symbols.

302.10 Compilation source materials for map update.

Compilation source materials are essential for States that want to update line work developed in the STATSGO database. Additional data are available in areas where soil surveys have been

completed. The compilation source materials used to develop the map data for the first version of STATSGO are stored in the States.

The MO leaders will query States on the availability of 1:250,000-scale USGS mylar topographic base maps and original punch-registered mylar overlays with soil boundaries. Each MO leader will prepare a letter with a list of needed material to the Director of the NCGC for processing. The list of materials available from NCGC are:

(a) 1:250,000-scale USGS mylar topographic base maps;

(b) Punch-registered mylar overlays for drafting new soil boundaries;

(c) Registration pins;

(d) Soil survey general soil maps ratioed to 1:250,000 scale on mylar;

(e) SSURGO recommended pencils for compiling lines for scanning; and

(f) Merged national STATSGO digital map data. This layer replaces the State subsets from the 1994 published STATSGO data set. Indicate the desired data formats for the spatial and tabular data.

302.11 Compilation procedures for new or modified map unit polygons.

(a) Delineate map units using available references such as soil survey maps, published and unpublished (hardcopy or digital), county general soil maps, State general soil maps, MLRA maps updated for Agriculture Handbook 296 entitled *Land Resource Regions and Major Land Resource Areas of the United States*, satellite scenes, normalized difference vegetation index (NDVI) maps, and shaded relief maps. Photographic reproductions of reference maps at 1:250,000 scale can be ordered from the NCGC to facilitate compilation. Refer to section 302.10.

(b) Draft soil map unit lines and symbols using SSURGO recommended pencils on the drafting overlay, which is punch registered to fit the USGS base map mylar. Transfer the USGS border neatline to the overlay. Keep the pencil intensity consistent to facilitate scanner digitizing. Pencils and registration pins are available from NCGC.

(c) Label new map units with the assigned national symbols and appropriate MLRA symbols. Refer to section 302.13(d)(3, 4 and 5) for procedures to acquire a new map unit symbol.

(d) Compute map unit acreage in a geographic information system after digitizing.

302.12 Determining map unit composition.

State soil survey staffs will submit their verification procedures to the MO with the compiled maps for review.

(a) Transecting to determine the proportionate extent of each component in the map unit from the published or interim soil survey report.

(1) Plot transects on published soil survey atlas sheets or unpublished soil survey field sheets. Plot the transects so that they cut across the more detailed delineations making up the corresponding map unit on the general soil map. Transects should be plotted first on the general soil map so that they afford complete and representative coverage of the respective map unit. At the judgment of the soil scientist, they should be located to intersect delineations of soils most representative of the map unit when subsequently plotted on the published atlas sheets or field sheets for measuring. Generally, transects are located at right angles to drainage patterns, include the complete range in elevation, represent the typical landscape, and are uniformly spaced across the delineated map unit. All delineations of a map unit should be sampled by transects, the number of transects used being proportional to the relative size and complexity of the delineations.

(2) Measure and record the length of the segments of each component along the transect crossing the general soil map unit on the atlas or field sheets.

(3) Combine data on segment lengths for all delineations of each map unit. Using routine correlation procedures, determine those map unit components from atlas or field sheets that can be combined. Make combinations so that no more than 21 phases of soil series (phases of subgroups where series are not established) or comparable detailed units are identified as components of the map unit on the general soil map.

(4) Determine the percentage of the general soil map unit occupied by each component (as indicated by the percentage of the total length of the transects crossing the area of the general soil map unit).

(5) Calculate the area (in acres) of each soil component of the general soil map unit.

(6) Divide by total area of the general soil map unit and multiply by 100 to determine percent composition.

(b) Determining map unit composition from published or non-published general soil maps.

(c) Computing map unit composition from the SSURGO database.

(1) Compile new general soil map unit.

302.12 (c) (2)

(2) Label new unit.

(3) Digitize and label.

(4) Generate a check plot for verification.

(5) Intersect the SSURGO map covering update location.

(6) Group polygons by phase criteria – slope, surface texture, flooding, other phase, and ecological site.

(7) Sum area of phases within the general soil map unit.

(8) Divide each sum by the total general soil map unit acres multiplied by 100.

302.13 Digitizing specifications.

(a) Base maps. Base maps used for digitizing general soil maps must meet National Map Accuracy Standards. USGS 1 x 2-degree topographic quadrangles meet these standards and will be used. Base maps are to be on stable mylar material that is 0.004 inch (4 mil) thick to minimize distortion caused by contracting and expanding from changes in temperature and humidity.

(b) Reference system. The horizontal control for the Digital General Soil Map of U.S. is the North American Datum of 1927 which is the same as the compilation base.

(c) Data capture.

(1) Soil and water boundaries.

(i) Digitize each soil or water boundary within a 0.01-inch (0.254 mm) line width of the source document. Follow the centerline of the boundary. Represent each boundary with no greater number of coordinate pairs than is necessary to record the boundaries within the 0.01-inch (0.254 mm) limit.

(ii) Digitize “island” polygons as a continuous line segment with only a beginning and ending node.

(iii) Connect beginning and end points of each digitized line at a common intersecting point with another soil boundary, water boundary, MLRA boundary, or the map neatline.

(2) Map neatline.

(i) The map neatline serves as a soil boundary and forms the maximum extent of the digital data set. It is constructed as four straight line boundary segments. The beginning and ending point of each neatline will be identical to the four corner coordinate values of the 1 x 2-degree topographic quadrangle. These values are explicitly entered, not digitized. The corner coordinate values can also be extracted from an existing data base if the values were explicitly entered and not digitized. Soil boundaries intersecting the map neatline must have a common point of intersection with the map neatline, and they will not extend beyond or fall short of the map neatline.

(ii) The neatline must be a straight line in the map projection and horizontal datum required for the final data. If data are developed in a different map projection or datum, or both, map developers must take care to properly clip each USGS quadrangle to the straight neatlines in the projection and horizontal datum of the final data.

(3) Geographic control. Establish geographic control using the four corner coordinate values of the 1 x 2-degree topographic quadrangle.

(4) Nodes. Digitize nodes at the intersection of soil boundaries and the map neatline at the intersection of soil lines, at each quadrangle corner, and at the endpoint of lines where they join.

(5) Quadrangle naming convention. Data will be submitted to the NCGC in ESRI® Shapefile or Coverage format. File names will be 8.3 compliant. The naming convention for shapefiles follow the format syyxxx.nnn where

s – indicates data type
yy – indicates southeast latitude of quadrangle
xxx – indicates southeast longitude of quadrangle
. – separator between base file name and extension
nnn – content type (geometry, attribute, index)

Example: The Beeville quadrangle base file name is s28098 with the following archive file names:

Geometry file: s28098.shp
Attribute file: s28098.dbf
Index file: s28098.shx

The naming convention for coverages follow the format syyxxx where

s – indicates data type
yy – indicates southeast latitude of quadrangle
xxx – indicates southeast longitude of quadrangle

(d) Labeling.

302.13 (d) (1)

(1) Label position for new delineation. Position the coordinate point for the soil map symbol at or near the centroid of the digitized area. Move the coordinate point into the area if the centroid falls outside of the area.

(2) The soil map symbols to be attached to the centroid coordinate point are described in the section *Compilation procedures for new map units*.

(3) A national legend has been developed for the Digital General Soil Map of U.S. Map units are numbered consecutively beginning with the Arabic number 1 and preceded with the letter "s" (ex: s109). The maximum field width is six characters. The last symbol currently used is s9555.

(4) Request symbols for new map units from the owners of the national legend in NASIS.

(5) For all new map unit polygons, also include a second label called 'mlra2002' (4-character field width) that identifies the MLRA region that the polygon falls within. Coordinate the 'mlra2002' label assignment with MO staff.

(e) Spatial data format.

(1) Quadrangle format. Digital general soil map data sets are in or have been formatted into full 1 x 2-degree quadrangle format. MO leaders will coordinate data correlation and joining among neighboring MLRA Soil Survey Regions.

(2) Internal spatial reference. Coordinate values can be collected in any internal coordinate system during the digitizing process.

(3) External spatial reference. The following coordinate reference system is required for all coordinate data.

(i) Projection is Transverse Mercator and the grid system is Universal Transverse Mercator.

(ii) Quadrangles are retained in their appropriate grid zones.

(iii) Map units are in meters.

(iv) Horizontal datum is the North American Datum of 1927 that is based upon the Clarke 1866 spheroid.

(v) No x_ or y_coordinate shifts (offsets) are permitted.

(4) Data structure. Map data are in a vector structure (i.e., locations of delineation boundaries are represented as strings of x,y coordinate pairs).

302.14 Digitizing procedures.

All digitizing required in the update will be done by the NRCS Digitizing Units located in Salina, KS; East Lansing, MI; Columbia, MO; Bozeman, MT; Temple, TX; Richmond,VA; and Madison, WI. Digitizing procedures in place at the units will be followed.

302.15 Archiving procedures and specifications.

(a) Format. The Digital General Soil Map of U.S. will be archived in a seamless national layer for the contiguous 48 States and in separate layers for Alaska, Hawaii, and Puerto Rico with U. S. Virgin Islands.

(b) Data format. Map data will be archived in ESRI® Coverage format.

(c) Procedures. Forward all revised spatial data in quadrangle format to Fred Minzenmayer at the NCGC for inserting into the national layer.

(d) Future plans. Plans are to make the Digital General Soil Map of U.S. accessible via the World Wide Web for checking out features and checking back in features after updating.

302.16 Distribution procedures.

The revised data set will be ready for public distribution in December 2001 in formats compatible with mainstream geographic information system software and computer platforms. Data will be easily available as a national data set. Technical support, user guides and documentation, and software interfaces will be developed for customer support.

The spatial data distribution formats for routine public access will be ESRI® Shapefile, Coverage, and Arc Interchange. The tabular data distribution formats for routine public access will be Microsoft® Access and delimited ASCII. Other formats not commonly used by NRCS will be available through mutual agreement.

Data access will be through CD-ROM publication and downloading through the World Wide Web. Plans are underway to provide linkage through a data gateway.